

## BOOK REVIEWS

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**True Bugs of the World (Hemiptera: Heteroptera). Classification and Natural History.**—Schuh, Randall T. and James A. Slater. Cornell University Press, Ithaca and London. xii + 337 pp. Price US\$ 85.00.

This is one of the most important books on true bugs (Hemiptera-Heteroptera) ever published. The authors, Randall T. Schuh and James A. Slater, are some of the most distinguished contemporary heteropterists. Toby Schuh is currently George Willett Curator of Entomology at the American Museum of Natural History, New York, and the leading world specialist on plant bugs, Miridae, but has also greatly influenced modern views on the phylogenetic relationships of Heteroptera. Jim Slater is Professor Emeritus of Biology at the University of Connecticut, Storrs, and the leading specialist on seed bugs, Lygaeidae, as well mentor of several heteropterists including Toby Schuh.

A general account of true bugs is badly needed. Earlier general treatments on Heteroptera, like R. A. Poisson's chapter in "Traité de Zoologie" (1951) and K. H. C. Jordan's volume in "Handbuch der Zoologie" (1972) are largely outdated. Another recent attempt to treat all families of true bugs was N. C. E. Miller's "The Biology of Heteroptera" (1956, 2nd ed. 1971). However, this work concentrates on Miller's primary interest, the Reduviidae, while the treatments of all other families are brief and contain numerous factual errors. Finally, the accounts of heteropteran families in "The Hemiptera" by W. R. Dolling (1991) are restricted to the British fauna and are too deficient in its literature treatment to be of general use.

The book is aptly dedicated to two of the most distinguished heteropterists of our time, Pedro W. Wygodzinsky (1916–1987) and René H. Cobben (1925–1987), the latter being the author of the most comprehensive works on the comparative morphology of Heteroptera (Cobben 1968, 1978) which laid the foundation for the subsequent development of ideas on the phylogeny of Heteroptera.

Chapter 1 is a concise historical account of the study of the Heteroptera starting with earlier attempts at higher classification, especially Leon Dufour's divisions Amphibicorisae (semiaquatic bugs), Hydrocorisae (aquatic bugs), and Geocorisae (terrestrial bugs), and ending with the modern, phylogeny-based classification in seven infraorders: Enicocephalomorpha, Dipsocoromorpha, Gerromorpha, Nepomorpha, Leptopodomorpha, Cimicomorpha, and Pentatomomorpha. The impact of cladistics on contemporary heteropteran classification was earlier reviewed by Schuh (1986) and the most notable later contribution is the work by Schuh and Stys (1991) on cimicomorphan family relationships. The evidence for the monophyly of the seven infraorders as well as most families appears solid, but a few paraphyletic families still remain, e.g., the Lygaeidae and most likely other pentatomomorphan families.

The author's view on the phylogenetic relationships between the heteropteran infraorders is based upon the study by Wheeler et al. (1993) where morphological and molecular data (18S rDNA-sequences) were combined in a "total evidence" cladogram depicting the sequence of relationships (Enicocephalomorpha (Dipsocoromor-

pha (Gerromorpha (Nepomorpha (Leptopodomorpha (Cimicomorpha (Pentatomomorpha). This scheme, however, is identical to the single most parsimonious tree derived from molecular data alone while the consensus tree based only on morphological data groups the Enicocephalomorpha, Dipsocoromorpha, and Gerromorpha together. (Andersen [1995] should be consulted for the correction of some errors in Wheeler et al. [1993] in their presentation of the cladistic hypothesis based on morphological data). The morphological evidence supporting the cladogram (their fig. 1.1) preferred by Schuh and Slater is not discussed in any detail but is distressingly weak. For instance, there are no synapomorphies supporting the group Leptopodomorpha + Cimicomorpha + Pentatomomorpha and the relationships of the Dipsocoromorpha and Gerromorpha relative to this group + Nepomorpha are also unsupported. I therefore share the authors' view (p. 5) that we must await additional evidence (morphological and molecular) to test the scheme proposed by Wheeler et al. (1993).

Chapter 2 contains biographical notes on now deceased influential or controversial workers on Heteroptera, including much useful information on bibliographies, locations of collections, types, etc. A more general account of "Sources of information" (Chapter 3) contains additional information on literature and collections. A mandatory Chapter 4 on "Collecting, Preserving, and Preparing Heteroptera" describes traditional methods as well as a few new ones like "canopy fogging", "ultrasonic cleaning", and "critical point drying".

Biological information on true bugs can be found in the systematic sections of the book (see below) but the Chapters 5–8 on "Habitats and Feeding Types," "Wing Polymorphism," "Mimicry and Protective Coloration and Shape," and "Heteroptera of Economic Importance" provide general overviews and highlights some of the most striking adaptations of heteropterous insects. Despite being one of the smallest of the "major" groups of insects (with about 38,000 described species), the true bugs utilize an enormously wide range of different habitat types, including such atypical ones as webs of spiders and Embioptera (Plokiophilidae), termite nests (Termitaphididae), and the surface of the open ocean (the sea skaters, *Halobates*, belonging to the Gerridae). Unlike the other hemipterous suborder, the Homoptera, true bugs forage on a wide array of food items, such as every part of seed plants (and a few ferns), fungi, other arthropods, and blood from vertebrates. Although plant-feeding species make up the majority of Heteroptera, the phylogenetic hypothesis (see above) suggests that this habit is secondarily acquired from predatory ancestors. Wing polymorphism is extremely common in the Heteroptera and the account on this phenomenon (Chapter 6) is quite extensive and well written. An additional chapter on "Reproductive Biology" would seem appropriate here in light of many well studied groups exemplifying parental care (Belostomatidae), traumatic (hemicoelic) insemination (Cimicoidea and some Nabidae), sexual dimorphism and different mating strategies (several groups), etc.

The section on "Historical Biogeography" (Chapter 9) has clear introductory statements on the principles of historical (cladistic) biogeography as well as brief summaries of distributional patterns characteristic of each of the major zoogeographical regions.

As introduction to the descriptions of infraorders, families, and subfamilies of Heteroptera, a general account of morphology is provided (Chapter 10). This section

is necessarily brief, but numerous references to the extensive literature on the subject make this an excellent introduction to the structural diversity of bugs. A key to the infraorders of Heteroptera (p. 65) concludes the chapter. I doubt, however, that this key will be useful as starting point for the identification of unsorted bug specimens. A survey of the many excellent habitus figures in the systematic chapters would probably put the user on the right track in most cases and enable him or her to continue through one of the family-keys.

The remaining 218 pages of the book (Chapters 11–92) are devoted to the systematic treatments. Taxa are grouped by infraorder, superfamily, family, and subfamily. Diagnoses are provided for all categories except superfamily. The structure of information presented for each family is standardized for most parts, with a general introduction, diagnosis, classification, specialized morphology, natural history, and distribution and faunistics. Keys are provided for families and subfamilies. The strictly uniform format followed for each family is one of the major strengths of this book. It allows the reader to extract comparative information on morphology, taxonomic diversity, natural history, distribution, etc., which again may be an inspiration for those who want to explore patterns of diversification and their probable causes. For instance, it is noteworthy that the “litter” habitat predominates (at least primitively) in the infraorders which are believed to be most basal in the heteropteran phylogeny (Enicocephalomorpha, Dipsocoromorpha, Gerromorpha). These three infraorders as well as the Nepomorpha and Leptopodomorpha contain only predaceous forms (the only exception being the chiefly detritus-feeding Corixidae). It is also interesting that the most speciose families comprise both predaceous (Reduviidae) and chiefly phytophagous forms (Miridae, Pentatomidae, Lygaeidae), but that the predatory habit has evolved (probably secondarily) in subgroups of the primarily plant-feeding families. In all, phytophagy appears to be a much more flexible strategy in the Heteroptera than in other phytophagous insect groups, including the Homoptera.

The book is profusely illustrated. The illustrations include beautiful habitus drawings of representatives of each family, numerous figures showing structural details of special relevance for each group, and several plates of SEM-micrographs showing details of legs, sensory and glandular structures, stridulatory structures, specialized hair structures, etc. The quality of reproduction of the photographs is excellent, revealing a microscopic world of great beauty. The SEM-pictures are original to this work while most other illustrations are reproduced (with due acknowledgements) from the extensive literature covered by the authors.

The book is concluded with an extensive (31 pages) list of references covering all pertinent literature on the systematics, morphology, natural history, distribution, and faunistics of Heteroptera. This list is one of the most useful features of any handbook and I have not been able to discover any significant omissions. A Glossary of (chiefly morphological) terms is provided as a useful supplement to the Index. The only thing missing is perhaps a sort of check-list of higher category names (to subfamily level), useful for museum curators of Heteroptera.

The book is very handsomely bound and its price is not unreasonable following today's standard. In conclusion, Toby Schuh and Jim Slater have done a marvelous job compiling an exemplary handbook which adequately covers one of the most diverse groups of insects. All heteropterists, most entomologists, and a lot of other

biologists welcome this outstanding handbook on True Bugs of the World which has been missing for a very long time.—*Nils M. Andersen, Zoological Museum, University of Copenhagen, Universitetsparken 15, DK-2100 Copenhagen, Denmark.*

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## ALL ABOUT THE MARAUDERS OF THE JUNGLE

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**Army Ants: The Biology Of Social Predation.**—William H. Gotwald, Jr. 1995. Cornell University Press, Ithaca. xviii + 302 pp. ISBN 0-8014-2633-2. Hard cover, £31.50.

When I met Gotwald in 1985 at the annual meeting of the French-speaking section of the International Union for the Study of Social Insects in Diepenbeek, I was a young, enthusiastic student in ant systematics. I found myself somewhat betrayed, as I was not allowed to study those fantastic, tropical ants I was reading about in novels such as *Marabunta* by Stephenson, dealing with those ferocious ants which threatened even the life of the pioneers out in the Amazonian jungle. And here was Bill Gotwald, specialist in those beasts. When I asked him about how it feels to be out there in the jungle to study army ants, he answered with some disappointment, that he has no 'lust' anymore, to be out there in the bush, to run all day long following tracks and not to see a lot. At least not enough to satisfy the National Science Foundation, which supported his projects. I was perplexed, to say the least.